

**A Framework for Assessing the Performance of Universities: The Case of Cyprus**

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**Abstract.** The teaching and research missions of universities have been broadened to include third-mission activities. While the traditional missions of teaching and research have been thoroughly examined, third-mission activities are yet to be fully understood. A one-size-fits-all model of university assessment cannot be applied to all countries. Each university operates within a national and institutional context, which defines its role and performance. This paper adopts a refined version of the triple helix model to support the argument that business, government and university contexts determine the performance of the third role of universities. Evaluation of the performance of universities should be based on the overall experience and expectations of a variety of agents operating within academia, business and government. The results of this research indicate that the government should play a constructive role in creating operating conditions and institutional structures to improve the performance of universities in small economies.

Keywords: Universities; Third Mission; Triple Helix; Small Economies; Cyprus.

## 1. Introduction

Universities are considered to be key agents of economic and social progress. Their current role has added interactions with industry and society to the traditional missions of teaching (knowledge transmission) and research (knowledge generation) (Etzkowitz et al., 2000; Vorley & Nelles, 2008). During recent decades, in which industry-academia relationships have been intensified, universities have been required to abandon their ivory tower and address social needs and industry objectives. This “third mission” is concerned with the “generation, use, application and exploitation of knowledge and other university capabilities outside the academic environment” (Molas-Gallart et al., 2002:2). Although teaching and research are important objectives, the scope of universities is much wider (Paloma Sánchez et al., 2009). Universities should create the networks necessary to foster innovation, which is central to competitiveness and growth.

The third mission of universities is a major issue within higher education, but it has still not been fully examined. A number of studies have evaluated universities using different systems of indicators (Douglas Williams, 1995; Aghion et al., 2007), but the third mission of universities still lacks a cohesive methodology for measurement of its performance. A major problem is that the third mission is vaguely defined. Göransson et al. (2009) emphasise that it is still not clear which functions should be included in the third mission, which itself remains problematic as a concept. Moreover, the idea of the third mission differs greatly depending on the national context (Laredo, 2007). There is growing interest in the use of Intellectual Capital (IC) for the evaluation of universities (Paloma Sánchez et al., 2009). IC is composed of human capital, structural capital and relational capital (e.g., Stewart, 1997). A strong relational capital provides an environment which promotes knowledge sharing and growth. However, relational capital is strongly dependent on the national context. A general framework of performance, which would evaluate the third mission of universities in different countries, may therefore be unnecessary.

The growing importance of both interactions and knowledge implies a systemic approach to understanding, explaining and improving wealth creation. The first discussions of innovation systems concentrated on the National Innovation System (Freeman, 1987; Lundvall, 1992; Nelson, 1993). With the arrival of the knowledge-based economy and the growing importance of universities, research on the NIS began to focus on the relationships between industry, academia and government. Leydesdorff and Etzkowitz (2001:1) argue that the triple helix thesis assumes “that the university can play an enhanced role in innovation in increasingly knowledge-based societies”. The triple helix framework has, so far, largely been used to examine universities and their interaction with industry and government (Mowery & Sampat, 2004).

The triple helix model is a useful framework with which to understand the third

mission of universities. According to Lazzaretti and Tavoletti (2006:21), “Universities are so linked to their countries that the examination of their governance structures cannot leave aside the governance structures of national higher education systems”. Government intervention is required to ensure that knowledge is both produced and transferred (Rosli & Rossi, 2015). In addition, industry influences the third-mission activities of universities. The interactions of business with universities are subject to many different factors including dynamic markets and internal knowledge (e.g., Laursen & Salter, 2006; Drechsler & Natter, 2012). The organisational context of universities also influences the individual behaviour of academics and affects the interactions of scientists with the private sector (Ponomariov, 2008). As a result, third-mission activities are shaped by the national and institutional contexts of a country.

The current role of universities in the knowledge-based economy can be analysed using the triple helix model. This analytical framework, which emphasises the critical role of interactions between universities and other actors, can conceptualise the current role of universities within the innovation process. This paper uses the triple helix framework to evaluate the performance of universities in the small economy of Cyprus. The features of small economies justify research into the role and performance of universities within the context of small countries. These features include inadequate technological and policy infrastructures, an urgent need to import knowledge and expertise, limited markets, the central role of government and the overwhelming power of SMEs in the economy (e.g., Argenti et al., 1990; Sengenberger, 1993; Hadjimanolis & Dickson, 2001; Meyer, 2008).

There have been various empirical studies using the triple helix model, but they have provided limited insight into ways in which the role of the university could be shaped by the trilateral relationship of university-industry-government. Most universities are a long way from performing third mission activities because of various barriers. Identifying and overcoming these barriers could transform these universities into learning organisations. Moreover, the indicators of these studies are based on quantitative measures. However, evaluation of the third-mission activities of universities also requires the collection of interviewees’ perceptions of the role and performance of universities. Knowledge generation and distribution is dynamic and cannot be summarised using a single rating at one point in time, while the perceptions of agents are key to the consideration of process.

This paper uses the case of Cyprus to illustrate that a common framework to evaluate the performance of universities is both unnecessary and undesirable. This research offers pragmatic suggestions for further improvement of the role of universities and for the successful application of knowledge distribution in a small economy. The paper is organised as follows. Section 2 explores the literature, while Section 3 examines the Cyprus Innovation Union Scoreboard, to give a broad picture of the innovation system in Cyprus. Section 4 explains the research method used while Section 5 presents the empirical findings and discusses them. Finally, Section 6 provides conclusions and implications for future research.

## 2. Theoretical Background

In recent decades, universities have undergone in-depth change. In the late 1990s, Etzkowitz (1998) and Clarke (1998) alerted the world to the arrival of the ‘entrepreneurial university’, in which the creation, transmission and exploitation of knowledge comprise the institutional objectives of academia. The emergence of the third mission of universities, their contribution to economic growth and social progress, has expanded the traditional roles of teaching and basic research. These transformations have increased the number of functions that universities now need to fulfil. Alongside teaching and research, they are expected to help companies improve their innovative capacities and to provide solutions to a variety of social problems (Bonaccorsi & Daraio, 2007; Laredo, 2007).

The emergence of knowledge-based innovation has led to the transformation of universities (Etzkowitz et al., 2000). Universities are central players within a country, as they develop technology-based programmes for economic development. Such programmes may be undertaken to “improv[e] regional or national economic performance as well as the university’s financial advantage and that of its faculty” (Etzkowitz et al., 2000:313). Higher education and science should be linked to quality and excellence (Federkeil, 2008). “Evaluation, assessment and assurance of academic quality is intrinsic to higher education” (Brown, 2004:x).

A high degree of freedom and self-governance within universities has created a need for accountability, to allow its administration and partners to assess the performance of institutions. To fulfil their duties of accountability, universities need to improve their reporting mechanisms. According to Chatterton and Goddard (2003:19), “responding to the new demands requires new kinds of resources and new forms of management that enable universities as institutions to make a dynamic contribution to the development process”. Universities compete not only for academic staff and students but also for funds. For this reason, they need to produce reports that allow other bodies to evaluate their performance (Paloma Sánchez et al., 2009).

Several ranking systems exist for the first and second missions, including the Academic Ranking of World Universities and the Times Higher Education World University Ranking. These rankings are based on research, teaching, or even the award of Nobel Prizes to staff members. While rankings allow universities to understand their performance and improve their practices, third-mission activities are still not included in such rankings. Universities undertake a wide range of activities and engage in various economic, social and political relationships. Assessment indicators should present a balanced picture of their performance across all the main activities: teaching, research and innovation. Measuring the third stream activities of universities “needs a holistic approach that examines the main channels that bind universities to the rest of society” (Molas-Gallart et al., 2002:iv). The development of indicators for third-mission activities will enable universities to improve their contribution to industry, policy and society. The improvement of rankings could lead to positive policy changes at the systemic level and initiate university reforms (Hazelkorn, 2011; Rauhvargers, 2011).

The uncertainty about which activities can be regarded as “third-mission” reveals the lack of a methodology with which to explore and assess the engagement of universities with different stakeholders (Montesinos et al., 2008). Some projects have been undertaken to measure the third role of universities. For example, the Russell Group of Universities has developed a set of indicators which help to track third-mission activities. However, many of the measures/initiatives are very recent, and in many ways it is too soon to judge their impact thoroughly. Moreover, as Sheil (2010) argues, assessing the performance of universities should involve describing the expectations that are placed on institutions. Therefore, assessing the

performance of universities requires not only quantitative indicators but also qualitative data. Göransson et al. (2009) emphasise that the types of functions included in the third mission should be varied depending on the national context.

There is a growing interest in extending IC analysis from private organisations to public ones, such as universities. It is argued that this framework could be used as a heuristic tool with which to measure third-mission activities (Leitner et al., 2005; Mouritsen et al., 2005). IC could be used as “a communication device about how the public sector institution works to create value” (Mouritsen et al., 2005:285). In particular, IC is divided into three categories: human capital, which includes the talents and skills of individuals and groups; structural capital, which incorporates organisational structures, processes and culture; and relational capital, which incorporates the relations developed and maintained between the university and its partners (Bezhani, 2010; Secundo et al., 2010). Good structural capital provides an environment which encourages knowledge (Stewart, 2000). Structural capital can therefore increase relational capital. Piber and Pietsch (2006) argue that IC analysis cannot be applied to complex organisations such as universities. The evaluation of performance should be linked to institutional objectives, which are highly influenced by the national context.

Indicators are important as they reflect the performance of universities and ways in which it can be improved. There is no generic one-size-fits-all approach to the measurement of different universities’ third-mission activities. Each university operates within a distinct national context. This shapes the institutional features and culture that define how the third mission can be best undertaken (European Commission, 2009). Moreover, institutional diversification influences the activities that can be defined as ‘third mission’. “Data collection needs to be related to the context, to national and regional policies, to institutional views on third mission and, in many cases, to individual initiatives by some entrepreneurs at universities that constitute the main explanation of the success in implementing university-enterprise partnerships” (European Commission, 2009:19).

Universities in some countries are more entrepreneurial than in others (Smith and Ho, 2006). The National Innovation System could have a major impact on these patterns (Shane, 2004). According to Marques et al. (2006:1), “the national innovation system ... expresses the importance of forging liaisons and links between the various networks related to innovation in increasing an economy’s capacity to innovation”. Interactions among different actors within innovation systems are essential to produce, accumulate and diffuse knowledge in order to introduce innovation and promote competitiveness (Lundvall & Johnson, 1994; Archibugi & Lundvall, 2001). With the arrival of the knowledge-based economy, in which universities tend to play a vital part, and the growing importance of the innovation system, research on NIS began to focus on relationships between industry, academia and government. Etzkowitz and Leydesdorff (1995; 1997; 2000) have proposed the triple helix model to show the existence of a spiral pattern of relations and links between the three institutional agents: university, industry and government (Marques, 2006).

Different national contexts provide various opportunities to establish the processes of interactive learning (Lundvall et al., 2002). The literature on small economies outlines some characteristics that apply to all small countries. These features include: limited markets; scarce physical resources; a shortage of technical skills; a lack of competitive markets; an under-developed or non-existent high-tech sector; weak institutions promoting technological innovation; public dominance; and the predominance of SMEs (e.g., Edquist & Lundvall, 1993; Hadjimanolis & Dickson, 2001; Meyer, 2008). Businesses within small economies are unable to explore, retain, and exploit external knowledge in order to complement attempts at open innovation, while only a few agents inside an innovation system may retain the specialist

knowledge necessary for the evolution of a product (Laursen & Salter, 2004). Businesses might become extremely dependent on universities.

The interactions of universities and businesses can demonstrate many differences related to the structure and functioning of the NIS, including dynamic markets; the absorptive capacity of firms; a culture of innovation; and government support (e.g. Laursen & Salter, 2006; Drechsler & Natter, 2012). The lack of both dynamic markets and technological opportunities in small economies influence the use of search strategies by an individual business. Businesses tend to be formed in turbulent and dynamic markets, with shorter product life-cycles, technological change in production and uncertain demand, where they are unlikely to have all the resources and expertise needed to innovate quickly and cost-effectively. In small countries such as Cyprus, firms face less intense competition and therefore do not strive for the production of rapid innovations to gain competitive advantage (Drechsler & Natter, 2012:441).

Industry has a great impact on the interactions between universities and businesses. In order for businesses to engage in collaborations, they need to understand existing knowledge, and be able to use it and adapt it in order to create new knowledge. Learning about new technology requires a significant level of absorptive capacity. Cohen and Levinthal's (1990) concept of absorptive capacity addressed the particular competence that companies build in R&D, not only to manage internal innovation but also to enable them to access and absorb external knowledge inputs to innovation. When firms invest in R&D, they are involved in a process of learning and adaptation that enables them to recognise the value of new information, assimilate it and apply it to commercial ends (Cohen & Levinthal, 1990:128).

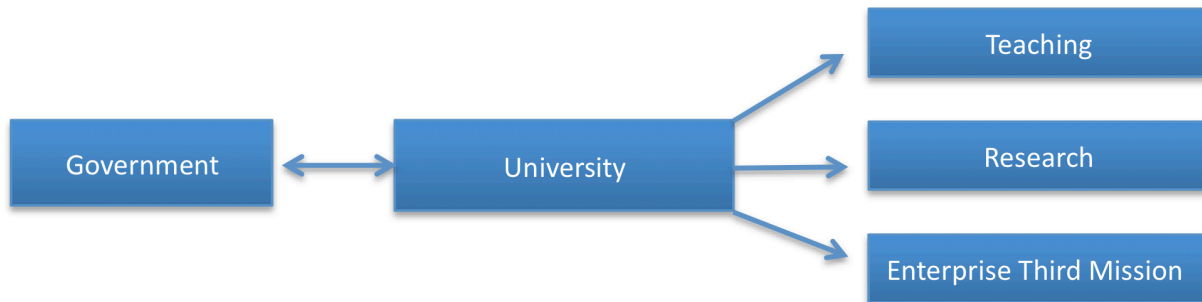
Many existing studies of cooperation between businesses have argued that culture is related to innovation and knowledge transfer. A key factor in business cooperation is the management of different organisational cultures, which “has become essential to master the network” (EIRMA, 2004:iv). A culture of innovation should support openness to new ideas, encourage risk-taking, trigger experimentation, tolerate creative mistakes, foster learning from failure and promote constructive dissent (Cummings & Teng, 2003; Herzog, 2011). The organisational context of universities also influences the individual behaviour of academics and affects the interactions of scientists with the private sector (Ponomariov, 2008). Culture cannot be acquired but must be built (Teece et al., 1997). Legal conditions, rules, and norms significantly affect an organisation's intention and ability to innovate (Edquist, 1997).

Universities are strongly linked to and influenced by governments, which have a dominant role within small economies. Market and institutional inadequacies, to which small countries are particularly prone (Hadjimanolis & Dickson, 2000), result in the state being a catalyst and facilitator of innovation. Governments can influence operating conditions and institutional structures, playing a constructive role in reinforcing relationships between academia and industry (Lee & Yoo, 2007; Yoo & Lee, 2009). In this way, governments ensure the efficient transfer of academic knowledge to the economy through funding and infrastructure.

Both national and institutional features shape the role and performance of third-mission activities. An analytical framework has been formulated in this paper by taking into consideration all the issues identified (see Figure 1). In summary, the analytical framework has been structured to incorporate existing innovation research on the triple-helix model (government-academia-industry linkages) and to evaluate the performance of the third mission of universities in small economies. The framework focuses on universities and their interactions with other players, in order to assess the expectations placed on the role and performance of universities. Moreover, it investigates the support that universities receive from government. The important catalytic role of national innovation policy in small economies

(Hadjimanolis & Dickson, 2001) could position the public sector as the facilitator of the third mission.

Figure 1. Analytical Framework



### 3. Evaluation of the National Innovation System in Cyprus

This research focuses on the case of Cyprus, a small country whose manufacturing industry is almost non-existent, whose industry infrastructure is poor, and where private involvement in research and development activities is absent. Exploring the third mission of Cypriot universities, and examining the expectations and barriers influencing their role, will contribute to the improvement of university performance in both Cyprus and other small economies. Before that can be attempted, it is essential to examine the Cypriot NIS, which provides the context in which universities operate. For a long period, historical conditions in Cyprus have prevented the establishment of a long-term economic policy aimed at sustainable growth. Not surprisingly, research and development (R&D) and innovation policy did not play a leading role in the development of the country (Violaris & Heide, 2007).

R&D was addressed first at the beginning of the decade, mainly as a result of the establishment of new universities and research organisations (see Figure 2). The establishment of the University of Cyprus and the Research Promotion Foundation have been important steps towards the promotion of Research, Technological Developments and Innovation (RTDI) in Cyprus. The accession of Cyprus to the EU in 2004 was the driving force behind the increased emphasis on innovation (e.g., Tsipouri & Rublova, 2010), and showed the government that changes were needed in order to harmonise its economy and research activities with those of the EU (e.g., Tsipouri & Rublova, 2009; Tsipouri & Rublova, 2010).

Figure 2. Evolution of RTDI Activities in Cyprus

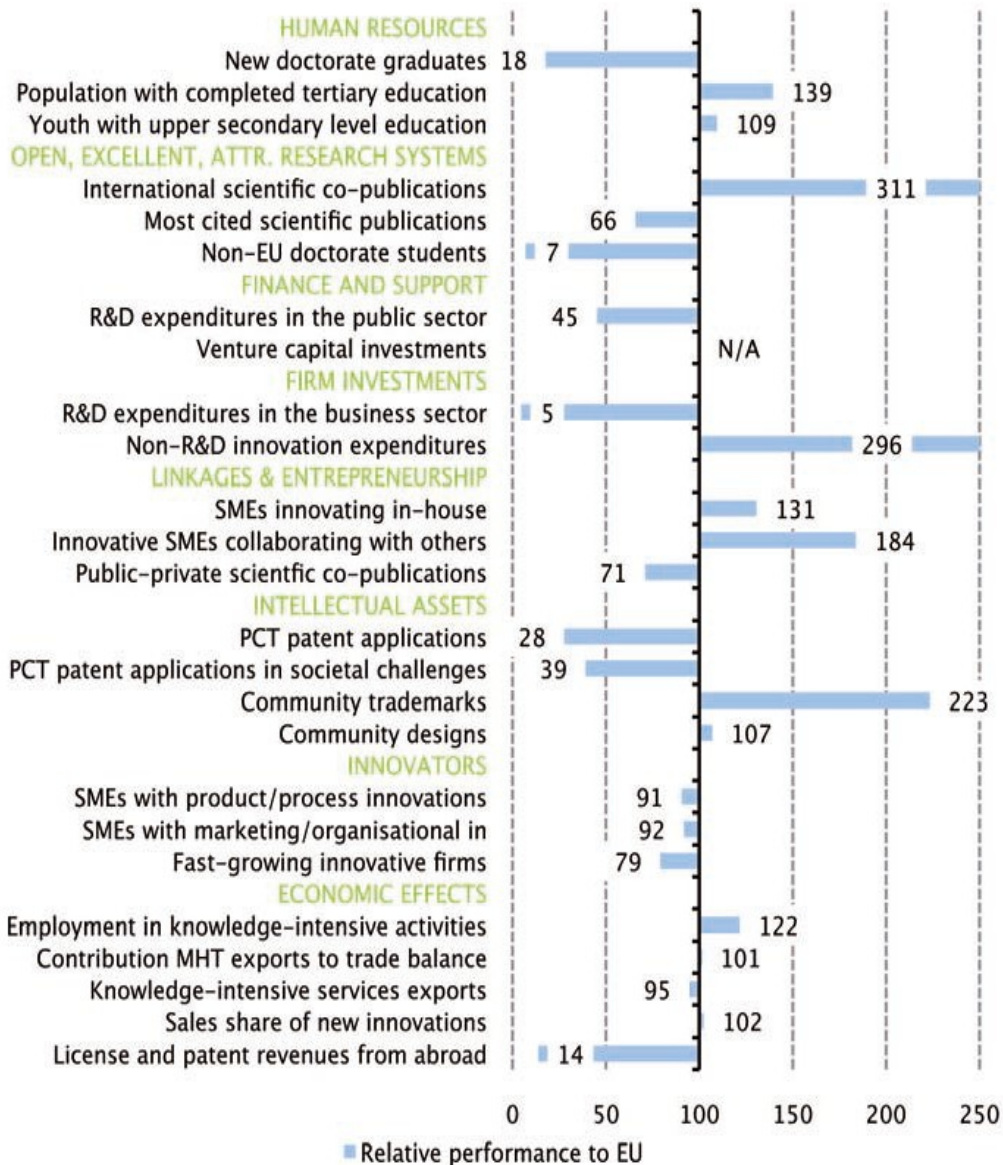
Time	Evolution of RTDI Activities
1960	Establishment of the constitutional republic of Cyprus.
1974	Division of the island/ Turkish military occupation.
Mid-1990s	Establishment of the first university in Cyprus, a small number of private colleges and of public research organisations.
1992	Establishment of the Cyprus Institute of Technology under the Ministry of Commerce, Industry and Tourism for the promotion of competitiveness and the technological upgrading of the Cypriot economy.
1998	Establishment of the Research Promotion Foundation for the promotion of scientific and technological research.
2003	Introduction of incubator scheme.
2004	Decision to establish a technology/science park.
2004	Accession of Cyprus to the EU.
2005	Enactment of the First National Reform Programme (NRP) 2005-2008.
2006	Establishment of the Cyprus Innovation Award by the Cyprus Employers & Industrialists Federation.
2007	Transfer of the activities and personnel of the Institute of Technology from the Ministry of Commerce, Industry and Tourism to the Research Promotion Foundation (RPF), along with the responsibility for incubator policies. Innovation added as part of RPF activities.
2007	Postponement of incubator schemes.
2011	Development of the Cyprus Association of Research and Innovation Enterprise by the Cyprus Chamber for Commerce and Industry.
2011	Creation of the National Council for Research and Innovation and of the Cypriot Science Council.
2011	Creation of the first Industry Liaison Office.

Evidence of the performance of universities in Cyprus is limited and inconclusive, and national evaluations are almost non-existent. To capture the multi-dimensional nature of universities, it is necessary to look at the Innovation Union Scoreboard, which tracks and benchmarks the relative innovation performance of the 27 EU member states, as well as other leading innovation nations. According to Hollanders (2009), innovation scoreboards can act as an early warning system for potential problems at the national level, can track changes in strengths and weaknesses over time, and can prompt policy makers to introduce policies that improve the innovativeness of firms (Hollanders, 2009:29).

Analysis of the Innovation Union Scoreboard indicates that the main institutions of the knowledge-based economy, including the government, universities and industry, underperform in Cyprus. Several indicators, including the low number of PhD holders (both EU and non-EU), the low share of highly cited publications, the limited expenditure on R&D by the public and, in particular, the private sectors, and the lack of public-private co-publications, strongly indicate that Cyprus has still room for significant improvement in its universities. A triple-helix model will encourage transfers of academic knowledge to innovating businesses and enhance their absorptive capacity.



Figure 3. Innovation Union Scoreboard Performance



Source: European Commission, 2014

A further examination of the interactions between universities, government and industry is required, in order to assess in more depth the current status of Cypriot universities and, more generally, to increase understanding of the third mission of universities in small economies.

## **4. Research Design and Method**

The exploratory nature of the topic meant that a qualitative research design was chosen for the empirical analysis. A qualitative approach made it possible to gain an initial understanding of the role of universities and an evaluation of their performance in a small economy; to identify the different perspectives of the various stakeholders; and to offer pragmatic suggestions for further improvement in university-industry interactions and for the successful implementation of the third mission. Understanding third-mission activities requires the collection of participants' perceptions of the ways in which institutions engage with each other. The process is typically experienced in different ways varies so the experience needed to be captured in the words of each participant. The in-depth interview method was therefore considered to be an appropriate and effective way of understanding the third-mission role of universities in small economies, and of generating in-depth data on the interaction between stakeholders. A qualitative in-depth interview approach was adopted in order to seek richer and deeper insights into university performance (Eisenhardt, 1989; Yin, 1989).

The interview-based methodology enables: the identification of different perspectives of stakeholders on the topic of interest; exploration of the interviewee's overall experience; an assessment of their interactions; the identification of any possible conflicts; and, finally, the evaluation of university performance in a small economy. Additional information was collected during workshops, events and public dialogues in order to inform and complement the interviews.

### ***4.1 Data Sampling***

The interview partners were chosen based on pre-selected criteria (purposive sampling) and recommendations by representatives of businesses (snowball sampling). Three main categories of innovation actors – entrepreneurs/managers, academics/researchers and public officers – were identified as being knowledgeable about and interested in innovation issues in Cyprus. A primary consideration was that these stakeholders held relevant personal views, beliefs and opinions, with no one stakeholder having preference over the others. Initially, the Technology Service of the Ministry of Commerce, Industry and Tourism was contacted to gather information on the key informants about innovation in Cyprus. 27 informants were interviewed, including employers' representatives, directors of incubators, academics and researchers, policymakers, and entrepreneurs. Sampling proceeded until newly gathered information ceased to provide new themes relevant to the research focus.

### ***4.2 Data Collection***

Personal contacts and email invitations were used to gather the pool of potential informants, and a self-introduction and a brief description about the study were provided. Informants were assured confidentiality and anonymity. The interviews were conducted face-to-face (with the exception of a few email interviews), and lasted between one and two hours. If permission was given, they were recorded, while detailed notes were taken in all other cases. The data collection was conducted over a period of four months. Most of the interviews were recorded, with permission, allowing a more accurate interpretation and verification of the responses, and consequent understanding and justification of the findings.

Semi-structured interviews were conducted. A semi-structured interview is a guided interview with broad areas of questions and topics, which do not constrain the interview and allow new questions to emerge during it (McMillan & Schumacher, 1993; Flick, 1998; Denzin & Lincoln, 2005). The interview guide (see Appendix A1) that outlined the format of the

interview helped to structure the interview, while at the same time maintaining a considerable amount of flexibility. This guide contained questions addressing different aspects of national innovation systems, relating to the role of universities in small economies (business investments in R&D, government policies, etc).

The interview was divided into three categories. The first set of questions required informants to discuss basic information about their background and the organisation for which they work. The second set contained generic questions related to the third mission of universities on topics including collaborations, knowledge transfers, and policies. It also explored specific contextual questions about the Cyprus Innovation System, including the low R&D investments and the characteristics of the Cypriot economy and industry. The final set of questions was designed to obtain an overall picture of the universities of Cyprus and to summarise the previous answers.

### ***4.3 Data Analysis***

The data analysis involved typing field notes and interviews, and developing themes and concepts. Content analysis was used to make apparent the cognitive concepts and the links between those concepts (Holsti, 1969). All the interviews were initially listened to twice and were transcribed as Word documents. Each transcript was cross-checked against the audio recording to ensure accuracy. After this transcription stage, the content of the interviews was analysed thematically. Codes were developed as patterns in the data emerged and these codes enabled the researcher to identify patterns of themes (Miles & Huberman, 1994; Carson et al., 2001). The data, grouped into categories/themes, was analysed to identify the assumptions held by the interviewees. The themes were then triangulated against the literature and background of the Cyprus Innovation System, and representative quotations were shortlisted for illustration purposes.

The quality of the study was ensured throughout the research process from the research design to the final findings. To avoid post-hoc rationalisation and to ensure validity and reliability, a triangulation of sources was undertaken (Ritchie & Lewis, 2003). Firstly, multiple sources of information were used in order to compare interview statements with the academic literature, official statistics and other publicly available documents such as media coverage, reports and newspaper articles (Yin, 1994). Secondly, multiple informants from different disciplines and different types of organisation were interviewed in order to provide different perspectives and to prevent biased opinions. Ethical issues were also considered at every stage of research in order to minimise any potential harm to participants while maximising the quality of the research (Anderson, 1990; Cohen & Manion, 1994). The research method dealt with the issues of informed consent, voluntary participation, respect for privacy, anonymity and confidentiality, and accuracy of report and result.

## 5. Results and Discussion

The findings, commentaries and illustrative quotations are described below. Individual stakeholders are identified by the following codes: N1 and N2 for employer representatives; C1 and C2 for incubator directors; G1 to G5 for policy makers; A1 to A6 for academics and researchers; and E1 to E13 for entrepreneurs (see Appendix A2). The findings of the study are organised into three categories. These categories include: R&D investment; university-industry collaboration; and R&D governance and performance. The order of the key themes that emerged differs from that of the interview, as it was rearranged to make it more logical.

### 5.1 R&D Investments

The interviews reveal the varying views of different stakeholder groups about the potential of Cyprus for R&D investments. The learning process can be hindered by the inadequate capacities of local firms (Varblane et al., 2007). In this process, companies need to understand knowledge, and be able to use it, and adapt it to create new knowledge. Learning about new technology requires a significant level of absorptive capacity. Cohen and Levinthal's (1990) concept of absorptive capacity addressed the particular competences that companies build in R&D, not only to manage internal innovation but also to access and absorb external knowledge inputs to innovation. R&D investments create a firm's internal capacity to identify and exploit new knowledge and therefore to produce innovation (Cohen & Levinthal, 1990).

While R&D activities are essential if the competitiveness of businesses and economies is to be sustained, there is still no clear understanding of the reasons for the low level of R&D intensity in Cyprus, or of any possible room for improvement. The Cypriot government is not convinced that Cypriot firms are willing to engage in technological innovation and R&D. In fact, it holds the view that the low demand for knowledge and innovation result from the size and the business structure of the economy, as indicated in the following statements:

The low involvement in R&D activities is attributed to a lack of interest from Cypriot firms. This is mainly due to the small size of the economy, the service-based economy and, of course, the small size of the firms. It is better to pay attention to other innovative activities that are a better fit with the structure of the economy. [G4]

Small countries are better able to absorb and adapt foreign technologies from industrialised countries rather than develop new technologies, products and/or services on their own. It is only large manufacturing firms which tend to invest in significant R&D, and with none of these firms in Cyprus, the demand for R&D investment is significantly small. [G2]

On the other hand, academics, business representatives and entrepreneurs reject the government's argument that Cypriot companies' lack of interest in innovation activities results from the business structure of the country. Evidence for this is found in the following statements:

The structure of the economy does not affect the level of R&D investment and innovation. Technology can be used anywhere. Cyprus is a small economy, a member of the EU, and, of course, a member of the global market. Therefore,

we cannot say that Cyprus is a small country. What matters is the launch of an innovative product and the hard work of those who develop it. [A6]

We live in the information era, and all companies should exploit the benefits of the information society, no matter what size they are. Today's evolutionary technology is creating an interdependent and interconnected world, while the present knowledge economy is producing enormous opportunities for small countries to compete and thrive in international markets. [E1]

Although it is true that in the past R&D was primarily undertaken by large traditional manufacturing firms, the increased importance of service sectors and the changes that have taken place in some services in the last several decades have made it clear that such pre-conceptions about the sector are no longer valid. Small service companies comprise a significant part of the business community in terms of revenue, employment, and opportunities for innovation, and should not be ignored in terms of innovation and R&D.

The ICT revolution has brought enormous changes to the social and economic world, and small countries have benefited most from the ICT revolution (Perez, 2002). The integrated global economy enables smaller states to adapt quickly to changing conditions and to identify and pursue strategic development policies. Interviewees from academia and the private sector referred to other small countries that are technologically advanced:

Size does not matter. Take the example of Israel. Israel is a small country, but it has become a global hub for innovation. We live in a knowledge-based economy in which all companies should exploit the benefits of the information society no matter what size the company is. ... Competitiveness is increasingly based on access to knowledge. [E11]

Globalisation and the emergence of the knowledge economy have indeed brought major changes: "The metaphor of a knowledge-based economy appreciates the increased importance of organised R&D in shaping systems of innovation" (Leydesdorff & Zawdie, 2010:6). R&D capability is a key factor in transforming a small and peripheral country into a knowledge economy (Musyck & Hadjimanolis, 2005). Small countries must invest in R&D in order to upgrade their absorption capabilities and to allow the economy to benefit from the expertise developed.

All interviewees pointed out that the Cypriot government does not measure R&D performance accurately. They also pointed out that companies do not include R&D expenses in their annual reports:

Even if the private sector invests in research, it will not declare this because it will be taxed. The most important factor that will stimulate the private sector to invest in research is tax breaks, a reform promoted by the EU which the Cypriot Government has attempted to establish in the past. [G2]

Although more than 50% of a company's expenses may be in R&D activities, we do not record these expenses in the accounting reports. If the government decides to give R&D tax relief, there will be much better recording of R&D activities. [E11]

In spite of the entrepreneurial nature of the Cypriot people, they do not have an innovation culture, and R&D is a low priority for Cypriot companies. The interviewees claimed that a focus on R&D is a fairly new trend in Cyprus, and that a research culture has not developed there yet. Moreover, they emphasised that Cypriots are followers rather than leaders:

Although Cypriots are very creative, they are conservatives. They prefer to buy an existing business rather than start a new one, so they take the safe routes. They make short-term investments instead of investing in long-term strategies and are not very inclined towards strategic planning [E1].

Cypriots are used to making easy profits. For example, a business which imports food from China has learned to work in a specific way. And it is really difficult to convince the owner to change the way he works and to reinvest his profits to grow his business. [C2]

In the late 1990s, Cypriot cabinet makers were buying furniture from Milan. They examined how the furniture was made and then produced the same furniture with different fabric. However, after Cyprus's accession to the EU in 2004 and the lowering of import duties, most of these companies closed as they did not innovate and thus could not deal with the competition. [N1]

Varsakelis (2001) stresses the role of national culture as a major determinant of R&D activity. Innovative early-stage R&D usually carries a high risk and must be adapted to a long-term horizon in order to realise potential commercial benefits, a culture which is almost non-existent in the average Cypriot business. SMEs often fail to realise how research could offer them an edge and, eventually, better cash flows. Firms that invest on a strictly short-term basis risk being ruined by what the economist Joseph Schumpeter called the "perennial gale of creative destruction", by which he meant technological obsolescence and market displacement (Schumpeter, 1943).

Interviewees highlighted the role of public dominance in the small economy of Cyprus, as the public-owned system retains a dominant position. Some of the largest organisations in Cyprus, including firms and research centres, are state- and semi-state-owned. Academics and entrepreneurs claim that the leaders of the country do not realise that the private sector is working for the public sector, and therefore do not give incentives to the private sector to maintain its growth.

Public-sector interviewees agreed that the rate of innovation and dynamism is significantly lower in public companies, and that government-owned firms are significantly less profitable than privately owned firms. Politicians cause government-owned firms to employ excess labour, offer higher wages than the rest of the economy, provide job security and, arguably, crowd out entrepreneurship. Several interviewees argued that Cyprus is a nation of conservatives and that the dream career of average citizens is in the public sector where they do not need to worry about losing their job.

Working in the public sector is a job for life. The government sector offers higher wages than the rest of the economy and arguably crowds out entrepreneurship. ... People, for example, dream of being teachers instead of

being entrepreneurs. You get generous pay and benefits and you work less than those in the private sector. [E7]

Cypriots are very creative and make good entrepreneurs. They are courageous and they invest, but their first goal is not research and innovation. However, this is reasonable. The government does not pay attention to these activities, so businesses do not realise their importance. Public authorities should convince the private sector of the importance of research and innovation. [N2]

As this indicates, the government must highlight the role of entrepreneurs in providing innovative products and emphasise the role of entrepreneurship in creating new jobs. The cultural factors influencing entrepreneurial behaviour must be at the centre of the research agenda (Cohran, 1960; Soltow, 1968). As cultural values are not inborn and can be taught (Hofstede, 1980), the task of the governments and policymakers of a country is to reshape its national cultural values so that they favour innovation. Legal conditions, rules, and norms significantly affect an organisation's inclination and ability to innovate (Edquist, 1997). The private sector, which is the ultimate engine of innovation and wealth, is strongly influenced by public policy and by the presence and vitality of public institutions (Furman et al., 2002), particularly in small countries where the public sector has a dominant role.

### ***5.2 University-Industry Collaborations***

Like the literature review, the interviews reveal the need for small countries to build elaborate collaborative systems that enable the upgrading of absorption capabilities and technological adaptability.

Business size does not play any role in the level of R&D investments. I noticed that many small firms innovate through research. Of course, due to their small size, they do not have their own in-house R&D but collaborate with research centres. Therefore, a small country should aim to strengthen its networking and efforts should be made to strengthen partnerships. [C1]

The interviewees emphasised that a gap exists between the academic and business sectors, and agreed that universities have, until recently, restricted themselves to a close circle of academics and students drawn from the upper strata of society, living in relative isolation. According to the interviewees, most academics maintain a distance from private firms, focus only on teaching and research and do not show much interest in practical applications, such as applied research or consulting. They argue that academics do not have any incentive to collaborate with the private sector. The participants stated that this is particularly true for the largest and most influential universities in Cyprus, the state universities that are dependent on government for their income:

Academics should stop being distant from the private sector. While academics keep their distance, it is impossible for firms to approach them. Small companies in Cyprus may not even realise how academics could help them and view the university as an ivory tower. Someone has to take the initiative to start collaborations. ... Academics should visit firms, speak to managers and try to link their research to the real problems faced by business. [A6]

Academics are not interested in collaborating with companies. In other countries, universities have a triple role – teaching, research and contributing to society. In Cyprus, professors are good at teaching and research, but they don't care about the integration of knowledge with business. They don't really care whether their research can be used by local businesses to help them become more competitive and so help the economy of the country. [C2]

Public universities have secure budgets. Academics do not have any incentive to get out of universities, talk to companies and look for possible solutions to their problems. They prefer to stay in the protected environment of the university and focus on their articles. It is difficult for small private firms to take the first step. [E1]

According to these interviewees, universities should make a greater contribution to the international competitiveness of the economy, particularly by commercialising their research (European Commission, 2005). The needs of society must be at the centre of a university's activities, and the ability to adapt flexibly to changing needs is necessary but still not present. The recent establishment of the Industry-Academia Liaison Office may improve the situation. The Minister of Education and Culture, Dr Demosthenous, has stated that “the new office will bridge the gap between the industry and the academic community by creating research-based and educational collaborations and facilitating technology transfer and innovation” (Demosthenous, 2011). However, this is not enough, according to the interviewees:

If you do not have a tradition of academia and research, you will not have transfer of knowledge. We are nowhere in Cyprus. We are at the very beginning. Other small countries, such as Finland, have had universities for hundreds of years. Institutional measures are needed to stimulate academic staff to seek external funding systematically and aim for closer collaborations with industry. [A3]

It is evident, therefore, that the government should provide academia with the right incentives to approach private companies. A motivational strategy would be to fund programmes that are not currently operating efficiently.

### ***5.3 R&D Governance and Performance***

The interviews demonstrate that the lack of government incentives is a serious obstacle to the development of a well-established framework. Despite recent progress in innovation policy, government priorities are still more traditional and bureaucratic ways of funding schemes directly. At present, the only incentives for R&D are provided by the Research Promotion Foundation (RPF), through research funding. Studies have reported that public financial support is effective in reducing financial constraints (Carreira & Silva, 2010) and motivating firms to undertake and complete innovation projects (Hashi & Stojcic, 2013). However, this is not always the case. Interviewees expressed their dissatisfaction with the way the RPF works and argued strongly that it is not suitable for local firms:



The RPF is incapable of attracting companies and making it easier for them to invest in R&D and innovation activities. Because of the considerable bureaucracy that dominates the RPF, there is no proper exploitation of the programmes. Research and innovation are dynamic processes and should not be delayed. [A2]

The bureaucracy of the RPF is enormous and small companies do not have the time or staff to apply for research funding. For example, a small company making dairy products in Cyprus wanted to invest in research, and employed a PhD holder who had an idea for a new product. After contacting the RPF office, the PhD holder decided not to apply for funding but to proceed with the research immediately and develop the new product. [N2]

It is quite difficult for a young entrepreneur to get a loan from a bank. Therefore, there are two sources of funding, family and public funding. But the bureaucracy of the RPF is huge. If I already had money, I would never bother applying for funding. [E6]

Furthermore, interviewers claim that a complete programme still does not exist which considers the commercialisation of research. Most projects have involved basic research rather than applied research, and so research funding generally does not lead to significant profit.

After the research has been conducted, there are no incentives to devise new applications. There is no funding for development and marketing activities. These steps are risky, and as a result, no-one takes them. If there were venture capital companies, things would be different. At present, the government should provide funding not only for research but also for development. [E11]

There is still no complete programme that covers the whole process from research to consumer. In particular, the involvement of academia in the programme we participated in delayed our progress. We had a bad experience as our academic partner neither thought nor cared about the application of the research in a business context or its commercialisation. [E2]

Because funding schemes are not targeting innovation as such, it is time to change their targets. Usually after funding has ceased, research has neither developed an end product nor reached the final stage of the market. [G2]

Cyprus is ranked lowest of all the EU countries for R&D because its politicians do not support R&D. R&D investment is therefore minimal to non-existent. Therefore, things must change at this level for progress to be made in Cyprus with respect to research. In our company, the efforts that are made are entirely down to us. We do not obtain any support from the Cypriot fund. [E12]

The interviewees are also critical of the behaviour of the people working in the foundation.

The RPF acts as though the companies want to steal from the public sector. You're considered guilty until you prove yourself innocent. So you lose valuable time trying to prove that you're not trying to exploit the foundation and steal money. It takes more time to explain your expenses than to conduct your research. [E7]

This behaviour may be because the RPF is run by the Ministry of Finance. ... The RPF should be run not only by the Ministry of Finance but also by the Ministry of Education in order to create a culture of innovation and promote academic involvement in innovation activities. [A1]

The interviewees claimed that the Cypriot research system is still new and that it needs the proper motivations and incentives to expand. The stakeholders expressed concern about the lack of long-term perspectives, while the lack of an clearly expressed basis for its decisions leaves the government open to criticism and accusations of poor governing processes. All the interviewees criticised the governing system for being institutionally weak and fragmented, and for the lack of consistency in its decision-making, and reported examples of the government's failure to effectively and sufficiently promote R&D:

Our own government does not believe in us. So how we are going to believe in our capabilities and invest in creating something new? Cypriots need the support and encouragement of the government. [E4]

Although several steps have been taken towards the promotion of research and innovation, we are still far behind. There are no clear programmes that target innovation, and it is still not clear under which institutional body innovation falls. To promote innovation, we should first focus on the institutional aspects of the issue. [A2]

The Government should change its mindset of writing perfect strategies on paper and then doing nothing to implement them, or starting something and launching it with empty promises (such as incubators and the Technology Park). The government should accept that a business can do research and produce innovation. [C1]

You can't just adopt strategic plans for a few years and then suddenly freeze everything. The government should have the flexibility to make changes where they're needed instead of abandoning everything. ... The government should have measured the success of the incubators in investment terms before starting to freeze the scheme. Take, for example, Company X. It started in an incubator in 2003 and today exports to more than thirty countries around the world. [C2]

Poorly conceived public policies can stifle, retard or penalise innovation because of the interaction of policies, attitudes and practices (Mytelka, 2000). The configuration of R&D programmes should therefore include clearer connections with everyday operations and with competitive advantages that lead to better financial results (Bougiouklis & Altsitsiadis, 2010). Programme officers should assess programmes from a business perspective and try to support SMEs with guidance on added value and networking strategies (Tapakoudis & Bougiouklis,

2011). They should offer a specific support service that extends to SMEs. Government officers agree that the government does not pay significant and necessary attention to R&D, and they admit that the government may not make the effort needed to support R&D.

The national reform programme includes only guidance, not measures. Action plans are missing. For example, the programme states that we must promote innovation in the public sector, but it does not specify the measures that should be taken. If the government had spent more money on innovation issues, then things could have been better. Still the Ministry of Research, which is the Ministry of Finance, has never bothered much with R&D activities. [G4]

Much can be done to improve the situation in Cyprus. First, the government should promote tax breaks for research and give more money to the projects that could develop new products than to those which couldn't, creating clusters and promoting cooperation in common core activities, while promoting innovative products by purchasing them. [G3]

As Hadjimanolis and Dickson point out (2001:805), “any effective policy that aims to stimulate technological innovation must go beyond science and technology policy and incorporate other policy instruments such as the regulation of markets, taxation, infrastructural development, etc.”. The roles played by government and by public policy and administration are particularly important and are key to the shaping of national cultural values in favour of innovation and to encouraging academic staff to approach the private sector. National institutional support systems and policy interventions are major channels of interaction, and should have central positions in the Cyprus National Innovation System. Government can influence the operating conditions and institutional structures, and can play a constructive role in reinforcing cooperation between academia, government and industry (Lee & Yoo, 2007; Yoo & Lee, 2009). Government support is required to ensure the generation and transmission of knowledge and the high performance of universities.

## 6. Conclusions

Since the emergence of the knowledge economy, global pressure on universities to lead the generation and transfer of knowledge has resulted in the third mission. The concept of the third mission remains ambiguous, while measurement of it lacks understanding. Some projects have been undertaken to develop indicators which can explore and assess the engagement of universities with a variety of stakeholders. However, a one-size-fits-all approach to measure the performance of all universities is considered unnecessary. Third-mission activities vary considerably between both countries and contexts (Göransson et al., 2009). Moreover, recently developed indicators only use quantitative metrics and miss subjective elements. Assessment of the third mission of universities should not just use quantitative measurements but should also be based on the overall experience and perception of the main agents.

This paper adopted the assumption of the triple-helix model that universities play a critical role in innovation (Leydesdorff & Etzkowitz, 2001), and used it to develop an analytical framework which emphasises the influence of national and institutional context on the performance of universities. The research used a qualitative analysis to illustrate this argument using the case of a small economy, Cyprus. The paper argues that the structure and functioning of the NIS, including markets, the absorptive capacity of firms, a culture of innovation and government support all influence the performance of universities. A qualitative research was conducted, based on interviews with the three main groups of innovation stakeholders, identified as entrepreneurs/managers, academics/researchers, and public officers. The research supports the assertion that it is critical to evaluate the perspectives of the main innovation actors about the current role and performance of universities in order to assess third role of universities. The paper assesses their interactions, identifies possible misalignments between them, identifies barriers that discourage universities from becoming learning organisations, and evaluates the performance of their third mission.

The evidence indicates that neither the university sector nor industry is sufficiently willing to collaborate with each other. Interviewees emphasise the role of the government as an organiser and initiator of innovation, and highlight its role in influencing the operating conditions and institutional structures, and its constructive role in promoting the third-mission role of universities. Given the characteristics of small countries, a distinct triple-helix model, which emphasises the role of government over industry and university, is suggested in order to overcome weaknesses to which universities in small countries are particularly prone.

The study finds that universities in different countries cannot perform in the same ways and therefore should conceive the performance of their third mission role in different ways. The national context, including lack of competition, low R&D investments, lack of innovation culture, and lack of government support influences the third mission of universities. The paper argues that government is responsible for creating the institutional environment required to increase the performance of universities in a small economy. In particular, government can promote an economic, financial and legal environment that is conducive to innovation and the diffusion of new technologies (Ferguson & Wascher, 2004). Measures that could improve the performance of universities include: raising public awareness of R&D and innovation; supporting academic/research cooperation with communities and business; improving understanding of the intellectual property system; enhancing the national research infrastructure and setting up a variety of intermediary institutions supporting innovation; increasing the number of PhD holders; creating an innovation policy and supporting innovation more effectively.

In particular, within the context of the economic crisis, the Cypriot government and the country's universities should take initiatives to increase the influence of the Cypriot diaspora over policy making, applied research and innovation. Retrieving the knowledge and capabilities of emigré scientists could be a catalyst for strengthening local technological capabilities and competitiveness (Meyer, 2001; Meyer & Wattiaux, 2006). The emigration of scientists has been a critical issue in Cyprus. The brain drain has long been viewed as a serious constraint on Cyprus national development. The current President of Cyprus, Nicos Anastasiades, argues that "It is well known how many of our eminent scientists live abroad at a time when we need them in our country. ... We need to create conditions so that they can remain, through incentives and working conditions so that our intellectual capital is not exported abroad" (Anastasiades, 2014). However, according to Meyer (2001), the traditional emphasis on reversing outward flows should be shifted to a connectionist approach in which the outflow of scientists is converted into an accessible asset of expanded networks. The large Cypriot scientific diaspora could play a critical role, not only as a means of networking for local universities, but also as a 'valve' reducing the pressure on them to deliver. Links, associations and knowledge networks could transform the brain drain into brain gain (Meyer, 2001). Policy initiatives should aim to develop and manage links between the scientific diaspora and their country of origin.

This paper has shown that the third-mission role of a country's universities depends on its national and institutional context. A refined version of the triple-helix framework can be used to assess the performance of universities. A distinct triple-helix model of university-industry-government in which the government plays a constructive role in promoting the triple-helix paradigm could improve the performance of universities in small economies. A mixed-methods approach is the most appropriate way of accurately assessing the performance of universities. When studying the role of universities, it is important to understand the expectations that industry, government and academia have of their role. The governance of universities in small economies is characterised by major state controls, and thus government should take more initiatives to improve the performance of universities. Qualitative research based on interviews with the main innovation stakeholders will provide clearer insights into government policies that could promote the third role of universities and then strengthen the impact of universities on innovation performance in a small economy. But it is still unclear what could motivate government to make the changes necessary to develop the third role of universities. Further investigation is therefore needed to determine what motivates the governments of small economies to create policies to support innovation.

To be successful, the implementation of innovation policies needs to acknowledge the important role of the public sector. Dubina et al. (2012: 1-2) state: "The more advanced and mature a knowledge economy (creativity economy) and knowledge society (creativity society) are, the more knowledge, innovation and creativity can be absorbed and are even being demanded for further progress". The triple helix, while placing the emphasis on knowledge production and innovation in the economy, does not take into account the knowledge society. According to Carayannis et al. (2012), the development of a knowledge economy is not sustainable without the co-evolution of a knowledge society. Policy making and industry strategies should take into account the demands and needs of society. The critical role of the public sector in the production of knowledge and innovation has been recognised, and a fourth helix has been added to the triple-helix framework. The fourth helix of the quadruple-helix model integrates the media-based and culture-based public with the civil society (Carayannis & Campbell, 2009). In order to strengthen the role of universities, the government should give particular emphasis to a culture of innovation, for the promotion of knowledge and media, and

the diffusion of knowledge and culture (Carayannis & Campbell, 2009, 2015). In comparison with the triple-helix model, the quadruple helix has been adopted more as a discourse and less as a policy-making tool. There are several promising opportunities for future research which could deepen scholarly understanding of the role of universities in the 21<sup>st</sup> century, together with interplay of external partners, including civil society, thereby leading to further developments in the emerging literature on the quadruple helix.

Finally, future research to link this paper's qualitative approach to quantitative indicator-based assessments is needed to complement this study. A quantitative paper should concentrate on triple-helix interactions and demonstrate the effectiveness of the triple-helix model in facilitating the third-mission activities of universities. A study based on the Community Innovation Survey (CIS) data should examine the impact of universities on the innovation performance of businesses using the triple-helix framework. Understanding the dynamics of the relationships between universities, industry and government could provide an insight into the influence of universities on the innovation performance of business. Based on the assumption that R&D investments (Industry), government support (Government) and interactions between universities and industry (Academia), increase the impact of universities on business performance, hypotheses could be formulated in relation to the direct and indirect effects of the triple-helix interactions on university performance. The triple-helix model could be used to reveal the factors that determine the crucial role of universities and their performance in relation to the innovation performance of firms.

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## Appendices

Table A1 Semi-Structured Interview Questions

Topics	Questions
Basic demographics and organisational details	<p>What is your educational background and working experience?</p> <p>When were you appointed/elected to the organisation?</p> <p>Where is the head office of the firm situated?</p> <p>How many people work for your organisation and how many are employed in R&amp;D?</p> <p>What percentage of your total costs does your organisation spent on R&amp;D?</p> <p>Do you perform R&amp;D/innovation on a continuous basis?</p> <p>What percentage of your total R&amp;D costs is funded by government?</p> <p>How did the firm get started? What was the main idea behind its establishment?</p> <p>Did you face any difficulties finding the appropriate staff?</p> <p>Are your innovation activities always linked to research?</p> <p>Have you ever applied for a patent?</p>
National Innovation System	<p>Have you ever applied for research funding programmes from the Research Promotion Foundation?</p> <p>Are you satisfied with the Research Promotion Foundation?</p> <p>What is your opinion of national innovation policies?</p> <p>What is your opinion of incubators?</p> <p>Why do you think the percentage of R&amp;D activity investments per GDP is so low (e.g., economy structure, culture, innovation policies)?</p> <p>Do Cypriot entrepreneurs invest in R&amp;D/innovation?</p> <p>Are Cypriot entrepreneurs creative?</p> <p>Does Cyprus have the level of staff necessary for R&amp;D/innovation investments?</p> <p>Should Cyprus promote investment in R&amp;D or place emphasis on other activities related to innovation?</p> <p>Who are your major collaborators? How easy is it to find potential collaborators from other countries?</p> <p>How easy is it to approach academics for possible collaboration?</p> <p>To what extent are there linkages between government, the private sector and academia?</p>
Challenges	<p>What are the main barriers to innovation in Cyprus?</p> <p>What could be done to improve the situation (e.g. by government, universities and industry)?</p>

Table A2 Demographics of Respondents

Stakeholder Groups	Respondents
National Employer Organisations	N1-N2
Government Bodies	G1-G5
Incubators	C1-C2
Academia	A1-A6
Private Firms	E1-E13